

# n-Hexane Use in Vehicle Repair

**Long-term overexposure to n-hexane can damage the nerves** in the feet, legs, hands, and arms. The damage can last a long time and may become permanent. The symptoms include numbness, tingling, weakness (sometimes even paralysis), and reduced ability to feel touch, pain, vibration, and temperature. Short-term overexposure can cause headache, dizziness, loss of appetite, giddiness, and drowsiness. Health effects have only been reported when exposure levels were above California's workplace Permissible Exposure Limit—but people working with n-hexane can easily be exposed to levels that high. This Health Hazard Advisory was prompted by cases of nerve damage identified among auto mechanics using spray brake cleaner that contains n-hexane.

**Health  
Hazard  
Advisory**

## How to know if you are working with n-Hexane

Hexane is a solvent. It's used mainly in vegetable oil extraction and in cleaners, degreasers, glues, and spray paints. n-Hexane is one kind of hexane. Commercial hexane usually contains 20% to 80% n-hexane, so you should treat all hexane as if it's n-hexane. Pure n-hexane is a colorless, very fast-evaporating liquid with a faint disagreeable odor.

In addition to the recent cases among auto mechanics, nerve damage from hexane exposure has been reported among workers making jet engine parts, furniture, shoes, sandals, and vegetable oil, and doing printing press proofing. Other workers likely to be exposed to hexane include laboratory workers, construction workers, and artists. Pure n-hexane is used in laboratories.

If you may be exposed to hexane at work, ask to see the Material Safety Data Sheet (MSDS) for each brake and parts cleaning product in your work area. Your employer must have an MSDS for any workplace product that contains a hazardous substance, and must make the MSDS available to you on request. If a product contains n-hexane, the MSDS should identify it in section 2 by the CAS number 110-54-3.

## Do you use any of these products?

Amrep Brake Parts Cleaner  
Berryman B-12 Chemtool Carb and Choke Cleaner  
Berryman Chemtool Air-Intake Cleaner  
Berryman Non-Chlorinated Brake Cleaner  
Certified Labs Dylek PS Aerosol  
Continental Research Brake Master  
Drummond American Corp. Strafe  
Loctite Disc Brake Quiet  
Loctite Flam Brake Clean  
Loctite ODC-Free Cleaner and Degreaser  
Loctite Pro Strength Degreaser  
Malco Brake and Parts Wash  
Malco Carb, Choke and Injection Cleaner  
Mantek DJC PS Aerosol  
Penray Non-Chlorinated Brake Gard  
Seymour of Sycamore Non-Chlorinated Brake Cleaner  
Sherwin Williams Automotive Cleaners  
Sherwin Williams Brake Parts Wash  
Sherwin Williams Cleaner/Degreaser  
Sherwin Williams Non-Chlorinated Brake Cleaner  
Sherwin Williams Parts Wash  
Taylor Made Non-Chlorinated Brake Cleaner  
Technical Chemical Non-Chlorinated Brake Cleaner  
Winzer Brake Cleaner, Non-Chlorinated  
Würth Brake and Parts Cleaner (liquid and aerosol)  
Zep Aerosol Brake Parts Cleaner  
Zep Brake Wash (liquid)  
Zep Parts Cleaner (aerosol)

(These are some products reported to contain hexane in a recent survey. However, products like these can change their ingredients quite often. Be sure to check the MSDS for whatever products you're using.)



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## How n-Hexane enters your body

n-Hexane enters your body when you breathe n-hexane vapors or droplets of spray in the air. Some can enter your body when hexane touches your skin.

Your risk of health effects depends on the amount of n-hexane that enters your body. That depends mainly on the amount (the concentration) of hexane in the air and how long you are exposed.

## How n-Hexane can affect your health

**Nervous System Effects.** Repeated overexposure to n-hexane (probably for months) can damage nerves in the feet, legs, hands, and arms. This is called peripheral neuropathy. The first symptom is usually numbness or tingling in the feet and legs, and then in the hands. There may be reduced ability to sense touch, pain, vibration, and temperature. Muscles may become weak, especially in the hands, legs, and feet. In severe cases, there may be muscle wasting (shrinking) and, rarely, paralysis. These effects often slowly improve if exposure is stopped, but they can last for many months and may be permanent. The symptoms may even continue to get worse for a few months after exposure stops.

Short-term overexposure can temporarily affect the brain, causing headache, dizziness, loss of appetite, giddiness, and drowsiness. These effects disappear within hours of stopping exposure.

Nerve damage has occurred among workers exposed to air concentrations of n-hexane only a little above the workplace Permissible Exposure Limit (50 ppm—see below). If exposure is not controlled, workers can easily be exposed to levels well above 50 ppm. Exposures high enough to cause short-term effects on the brain are also high enough to cause peripheral neuropathy if the exposure happens frequently.

n-Hexane is more likely to damage nerves if you use it together with acetone, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), or lead acetate. Don't use hexane in combination with these chemicals.

n-Hexane breaks down in the body to form methyl n-butyl ketone (MnBK) and 2,5-hexanedione (2,5-HD). Those are the chemicals that actually damage the nerves. Some products may contain MnBK or 2,5-HD. Do not use those products.

**Other Effects.** n-Hexane is not likely to cause health problems other than those described above. Exposure to very high levels (20 or more times the legal exposure limit) damaged the sperm-forming cells and the lungs of test animals. However, these effects have never been reported in humans. Hexane does not appear to be a special hazard to pregnancy. Hexane does not cause genetic mutations. We do not know whether hexane can cause cancer; when it was tested in animals, the results were unclear.

## Are there any tests for health effects and exposure?

A neurologist or a doctor who specializes in occupational medicine can test whether your nerves are damaged. The simplest way is to test nerve conduction velocity (how fast a nerve carries a message). Nerve damage from hexane exposure usually occurs on both the left and the right sides of the body equally. Symptoms on just one side are likely to have some other cause, such as diabetes, carpal tunnel syndrome, medications, or alcohol.

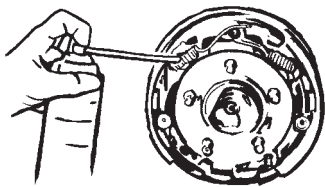
A urine test for the toxic breakdown product, 2,5-hexanedione, can be used to estimate exposure within the last week or so. The best time for such a urine sample is at the end of the last shift of a workweek. n-Hexane and its breakdown products are not stored in the body very long. They are eliminated fairly quickly in the breath and urine, although the amount in your body can increase over a workweek if you're exposed every day.

Workers who will be regularly exposed to hazardous substances should be given a complete physical examination at the beginning of their employment. The exam should include medical and work histories. They should also have periodic follow-up examinations.

## How to control your exposure

Your employer must protect you from being exposed to chemicals at levels above the legal exposure limits. Cal/OSHA and the Cal/OSHA Consultation Service can help you and your employer—see the “Resources” section on page 4.

**Substitution.** The surest way to protect yourself is to switch to products that don't contain hexane. Avoid using products for which you do not have an MSDS.



Especially avoid using products that combine hexane with acetone, MEK, MIBK, or lead acetate.

Switch to water-based (aqueous) cleaners for

cleaning of brakes and other vehicle parts. Some aqueous cleaners work as well as solvent cleaners, and they don't pollute the air in the workplace or the environment. Unlike solvent cleaners, aqueous cleaners are usually non-flammable. An aqueous cleaning system will probably even save the shop money, because an automated aqueous spray cabinet for cleaning parts can greatly reduce labor time. Aqueous cleaner also lasts longer, so you won't need to buy as much of it.

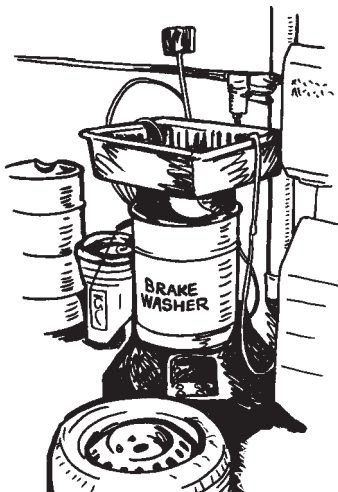
Environmental compliance may also be easier, and you can reduce your hazardous waste disposal costs.

Experience shows that switching to an aqueous cleaning system can pay for itself within as little as three months to a year. Many vendors will offer their aqueous systems free of charge for a testing period of a week to a month to help you select the best system for your shop. (See the "Resources" section for more information.)

If you can't switch to hexane-free products, take other steps to limit your exposure.

**Use Less.** If you must use hexane products, use as little as possible. Keep containers closed between uses. Hexane can evaporate quickly from a hexane-soaked rag, so make sure that used rags are kept in a well-ventilated area.

**Ventilation.** Make sure that there is good ventilation. "Local exhaust ventilation" is most effective; it captures contaminated air at the source, before the hexane can spread into your breathing zone. Next best is general ventilation, which uses a fan-powered system to bring fresh air into the work area. Open doors and windows usually provide very little ventilation. An indoor fan that just blows contaminated air around without removing it from your work area is not effective.



**Respiratory Protection.** Hexane has very poor "warning properties" (that is, it has little odor and isn't very irritating). Only supplied-air respirators are approved for protection against hexane. Filter respirators are not approved, because when the cartridge "wears out," there is no warning to alert you that the respirator no longer provides protection.

**Skin Protection.** It may be hard to avoid getting parts cleaning products on your hands. If you can use a water-based cleaner and make sure that it's pH neutral (to prevent irritation and burns), you probably won't need protective gloves. If you must use hexane products and it is likely that you'll have a lot of skin contact, wear protective gloves and replace them often. Viton and polyvinyl alcohol are recommended, and Silvershield and chlorinated polyethylene are also good. Other glove materials, such as latex rubber, provide very poor protection against hexane. California law requires an employer to supply gloves or any other necessary safety equipment at no cost to the employee.

## Regulations that help to protect workers

**Permissible Exposure Limits.** The Cal/OSHA Standards Board sets Permissible Exposure Limits (PELs) for the amounts of certain chemicals in workplace air. The PELs are intended to protect the health of most people who are exposed every day over a working lifetime.

Cal/OSHA's PEL for n-hexane is 50 parts of n-hexane per million parts of air (50 parts per million, or 50 ppm). You may also see this stated as 180 milligrams of hexane per cubic meter of air (180 mg/m<sup>3</sup>). Legally, your exposure may be above the PEL at times, but only if it is below the PEL at other times, so that your average exposure for any 8-hour workshift is no more than 50 ppm.

**Monitoring.** If you work with n-hexane and think you might be overexposed, talk to your supervisor or your union. If any worker might be exposed to a substance at more than the legal limit, the employer must measure the amount of the substance in the air in the work area (Title 8, Section 5155(e)). You have the legal right to see and copy the monitoring results (Title 8, Section 3204).

You cannot rely on your sense of smell to warn you that you are being overexposed to n-hexane. n-Hexane has only a very faint smell, and it's not very irritating to the eyes, nose, or throat. You can easily be overexposed without knowing it. Measuring the amount in the air is the only reliable way to know the exposure level.

**Hazard Communication Standard.** Under California's Hazard Communication Standard (California Administrative Code, Title 8, Section 5194), your employer must tell you if you are working with any hazardous substances, must train you to use them safely, and must make Material Safety Data Sheets available.

**Injury and Illness Prevention Program.**

Every employer must have an effective, written Injury and Illness Prevention Program (IIPP) that identifies a person with the authority and responsibility to run the program (Title 8, Section 3203). The IIPP must include methods for identifying workplace hazards, methods for correcting hazards quickly, health and safety training at

specified times, a system for communicating clearly with all employees about health and safety matters (including safe ways for employees to tell the employer about hazards), and record-keeping to document the steps taken to comply with the IIPP.

**Access to Medical and Exposure Records.**

You also have the right to see and copy your own medical records, and any records of your exposure to toxic substances. These records are important in determining whether your health has been affected by your work. Employers who have such records must keep them and make them available to you for at least 30 years after the end of your employment.

# WHERE TO GET HELP

- **Cal/EPA** and the **U.S. EPA** have useful Pollution Prevention Toolkits on their '[Best Workplace Practices for Automotive Repair and Fleet Maintenance](https://www.epa.gov/saferchoice/best-workplace-practices-automotive-repair-and-fleet-maintenance)' web page. (https://www.epa.gov/saferchoice/best-workplace-practices-automotive-repair-and-fleet-maintenance) There are also pamphlets to help with "Switching to Water-Based Cleaners for Automotive Brake Cleaning" and "Switching to Water-Based Cleaners for Repair and Maintenance Parts Cleaning." You can get the toolkits, pamphlets, or accompanying videos from the [Pollution Prevention & Green Technology](#), in Cal/EPA's Department of Toxic Substances Control, at (916) 322-3670 (www.dtsc.ca.gov/PollutionPrevention/index.cfm).
- The **South Coast Air Quality Management District** maintains a [list of certified aqueous cleaners](http://www.aqmd.gov/home/programs/business/business-detail?title=low-voc-cleaning-materials-equipment-list&parent=other-low-voc-products) (http://www.aqmd.gov/home/programs/business/business-detail?title=low-voc-cleaning-materials-equipment-list&parent=other-low-voc-products).
- **HESIS** produces fact sheets, booklets, medical treatment guidelines, and technical documents on workplace hazards. A HESIS Medical Guideline for hexane is available. All publications are free. Some are available in Spanish or other languages. For publications or for a list and order form, call (866) 627-1586, or visit the [HESIS website](http://www.cdph.ca.gov/hesis) (www.cdph.ca.gov/hesis), or write to HESIS, 850 Marina Bay Parkway, Richmond CA 94804.
- **California workers, employers, and health care professionals** who have questions about the health effects of workplace chemicals can call HESIS at (866) 282-5516 and leave a message with a specific, detailed question.
- **Employers** who want free, non-enforcement help to evaluate the workplace and to improve the health and safety conditions can call the Cal/OSHA Consultation Service at (800) 963-9424.
- **Employees** who want information or help with workplace health and safety regulations, or who want to file a complaint, can call the nearest district office of Cal/OSHA. [Find the Cal/OSHA Enforcement District Office](#) nearest your workplace on their website (www.dir.ca.gov/DOSH/districtoffices.htm) or look in the government section near the front of your local phone book under "State of California, Industrial Relations, Occupational Safety and Health".
- Other resources for employees may include your supervisor, your union, your company health and safety officer, your personal doctor, or your company doctor. For information on union-related health and safety resources, contact the **California Labor Federation** at (415) 986-3585, or your local Central Labor Council in the "labor organizations" section of the yellow pages.

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